

ON SOME MALAYAN AND OTHER SPECIES OF *CULICOIDES*,  
WITH A NOTE ON THE GENUS *LASIOHELEA*.

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(Plate III.)

The main purpose of this note is to give a name to the Malayan *Culicoides* that sucks blood from the abdomen of Anopheline mosquitos, and thus to afford cover for the publication of some very interesting observations made recently upon this species by Dr. W. A. Lamborn. At the same time, some account is given of the very few additional specimens of Oriental *Culicoides* in the British Museum—most of which were also collected by Dr. Lamborn in Malaya; and the opportunity is further taken to describe two other apparently new species of the genus, from Somaliland and Jamaica, respectively, which have recently been received at the Museum.

A note is added on the genus *Lasiohelea*, which seems to be, apart from *Culicoides* and *Leptoconops*, the only other Ceratopogonine genus of habitual blood-suckers. Some instances are given of the remarkably wide distribution of some members of these genera, showing the inadequacy of studying these insects merely from a regional point of view, as is more or less inevitably done by writers at the present time.

The first record of a Ceratopogonine midge attacking a mosquito was that of C. J. Fearnside (Ind. Med. Gaz., xxxv, p. 128, 1900), who observed "*Culex III and IV*" being attacked at Rajahmundry Gaol. His published figure and description show that the midge he observed was a species of *Culicoides*, perhaps identical with that described below. He states that he had not seen the parasite on any *Anopheles*.

Subsequently Captain Norman Lalor and Dr. A. T. Stanton independently observed the phenomenon at Kyankpyu, Lower Burma, and Kuala Lumpur, F.M.S., respectively, and published notes describing their observations (Paludism, No. 5, pp. 42 and 64), without naming or describing the midge concerned. About the same time Gravely (Rec. Ind. Mus., iv, p. 45, 1911) recorded a similar discovery at Calcutta.

So far as I have been able to ascertain, the midge which has these remarkable habits has remained till now unnamed,\* and I therefore describe it below. Since all the material which has been received at the Museum belongs to one species it seems probable that the records of Fearnside, Leland and Gravely, whose material I have not seen, also refer to the same species.

***Culicoides anophelis*, sp. n.** (Plate iii, figs. 4-7).

♀.—Resembles the African *Culicoides fulvithorax* (Austen)† so closely that a complete description seems unnecessary; the following are the only distinctions I have been able to discover:—Short sensory bristles present on most, if not all, of the first eight flagellar segments, though difficult to detect. The trilobed dark area on the anterior portion of the mesonotum is darker and more extensive, occupying at the maximum almost the anterior third of the mesonotum; there is also a more or less extensive dark brown area immediately in front of the scutellum; scutellum and

\* Fearnside and Lalor both state their intention of describing the species in detail, but do not appear to have done so.

† Synonyms: *Johannseniella fulvithorax*, Austen, 1912; *Culicoides ochrothorax*, Carter, 1919; *C. fulvithorax*, Carter, Ingram and Macfie, 1920; *C. citrinus*, Kieffer, 1921.

postnotum blackish instead of moderately dark brown. The line of division between the ochreous upper and blackish-brown lower parts of the pleurae is not very sharply marked. The three spermathecae are equal in size and almost globular, not unequal and sausage-shaped. Ground-colour of wings rather lighter, and the pale spots rather larger. First radial cell rather broader, generally closed by a fairly definite cross-vein (though in some specimens it is almost as narrow as in *C. fulvithorax*). A few scattered macrotrichia on the membrane of the apical fifth of the wing (these are present also in Austen's type of *C. fulvithorax*, though not mentioned or figured by Carter for *C. ochrothorax*).

The British Museum possesses the following material:—

MALAY PENINSULA: Pudooh Gaol, Kuala Lumpur (*Dr. A. T. Stanton*); five ♀ still attached to the abdomens of ♀ specimens of *Anopheles hyrcanus*, *A. karwari* and *A. maculatus*; also three other ♀♀ from *A. aconitus*, *A. fuliginosus* and *A. hyrcanus*. Kuala Lumpur (*Dr. W. A. Lamborn*); nine ♀♀ (mounted) from the species of *Anopheles* mentioned in the table below.

SUMATRA: Deli (per *Dr. A. T. Stanton*), one ♀, host not stated.

N.W. INDIA: Meenglas, Jalpaiguri, 26.vi.1921 (*M.O.T. Iyengar*); one ♀ on *A. maculatus*.

Dr. Lamborn's observations were made at Kuala Lumpur, F.M.S., between April 1920 and April 1921. During this period a very large number of Anopheline mosquitos were captured and examined, 26 of which were found to be attacked by the *Culicoides*. The following table, prepared by Dr. Lamborn, summarises these captures:—

Species of Anopheline.	Males captured.	Females captured.	Number of <i>Culicoides</i> taken on the females.
<i>A. vagus</i> , Dönitz .. .. .	1,539	3,306	18 (two on one host)
<i>A. aconitus</i> , Dönitz .. .. .	2,541	3,212	2
<i>A. karwari</i> , James .. .. .	6	17	3 (two on one host)
<i>A. fuliginosus</i> , Giles .. .. .	70	75	2
<i>A. umbrosus</i> , Theo. .. .. .	21	256	3 (two on one host)
<i>A. hyrcanus</i> , Pall. .. .. .	74	213	1
<i>A. subpictus</i> , Grassi .. .. .	—	46	—
<i>A. barbivostris</i> , V. d. W. .. .. .	47	168	—
<i>A. maculatus</i> , Theo. .. .. .	8	18	—
<i>A. kochi</i> , Dönitz .. .. .	71	65	—
<i>A. tessellatus</i> , Theo. .. .. .	107	183	—

No specimen of the *Culicoides* was found on a Culicine mosquito, but this was probably owing to the comparatively small number of these insects which was examined. In every case the parasites were found attached to some portion of the abdomen (generally on the sides of gorged individuals) of female *Anopheles*. The absence of parasites on the males, and on the thorax of the females, shows conclusively that the object of the parasite was to obtain the ingested blood, rather than the body-fluids of the mosquito itself, though Dr. Lamborn notes that in one or two cases no trace of blood could be found either in the host or the parasite. In other instances blood was present in both.

As had previously been noticed by Stanton, the parasites were not at all easily disturbed while at their meal, some remaining attached to the abdomen of the host even after the pair had been chloroformed. "These insects were in no wise disconcerted," says Dr. Lamborn, "even by the frantic endeavours of the captured Anophelines to escape." Observations showed that the parasites were either attached

by their mouth-parts only, entirely unsupported by their legs, or the front legs only were used in addition to the mandibles. They remained in this position for extended periods; in several cases for more than 48 hours.

Dr. Lamborn's most complete series of observations were made on a specimen found on *Anopheles vagus*, Dön., taken in the servants' quarters attached to the house of a European at Kuala Lumpur. Regarding this specimen, he writes:—

“ 11.iii.21. The host, replete with freshly absorbed blood, was taken with one of the parasites, the abdomen of which also showed bright pink, attached by its mouth-parts only to the third abdominal segment on the right side. On examination 48 hours later the parasite was seen to be still *in situ*, but at 9 a.m. on 14th March it was flying in the tube, free from its host. The tube containing the insect was then inverted over a bowl containing liquid mud, at the edge of which about 67 ova were found on 16th March. Five pupae were found on 23rd March on the surface film of water and 3 more on 25th March. Each of these afforded an imago on the third to fourth day.”

Eggs were also obtained on other occasions; in one case about 80, and in another 12. In the latter case the host showed no signs of having obtained a blood-meal.

Unfortunately neither males, larvae, nor pupae were represented in the material preserved by Dr. Lamborn, and presented to the British Museum, but apart from the bred specimens mentioned above, Dr. Lamborn writes that pupae were readily obtained from time to time, with those of the other species mentioned below, at the margins of small muddy pools, well in the shade.

No case of *Culicoides* parasitising other blood-sucking insects has yet been recorded from Africa, but the following observation of Dr. Lamborn's is of interest in this connection:—

“ The facts [regarding *C. anophelis*] recalled to the mind of the writer an observation he made in 1916 in reference to *Glossina morsitans* in a fly area near the Tarengere River in Tanganyika Territory (and recorded in an unpublished report, dated 8th February 1917, to the Colonial Office), that some female flies exhibited on the lower surface of the abdomen dark patches with a central depression, suggesting puncture. No opportunity of ascertaining the cause of this arose. Dr. G. D. H. Carpenter suggested that it may have been due to attack by Tachinid flies, but a more probable explanation would seem to be that the flies are assailed by some insect for the purpose of depriving them of their ill-gotten meal, much as the Anophelines are attacked by the little *Culicoides*.”

#### ***Culicoides guttifer*, de Meij. (Plate iii, fig. 2).**

Several males and one female of this species were reared by Dr. Lamborn from pupae “ obtained at the margins of small, muddy pools, well in the shade,” at Kuala Lumpur.

Both in regard to wing-markings and hypopygial structure the species shows a very close resemblance to the West African *C. praetermissus*, C. I. & M. The chief differences are that in the wings the small pale spot immediately below and distal to the second large costal spot, which is present in *C. praetermissus*, is absent in *C. guttifer*; in the hypopygium, the lateral terminal processes of the ninth tergite are a little shorter and broader, and their terminal hairs are so minute as to be scarcely perceptible. Whether these small differences (I can find no others of any importance) indicate more than a varietal rank for *C. praetermissus* seems to me highly questionable. The single female mounted unfortunately does not show the spermatheca clearly, but it is probably single, as in the two allied African species.

So far as I can see, from an examination of the type, Kieffer's *C. leucostictus*, described from females only from the Seychelles Islands, is identical with *C. guttifer*. The European *C. pictipennis*, Winnertz, is also extremely similar.

**Culicoides oxystoma**, Kieff. (Plate iii, fig. 3).

Two females, which I take to be this species, were reared in company with *C. guttifer*. There are two points in which, if the above determination is correct, Kieffer's description is inexact. The clear areas of the wing-membrane, though appearing quite bare at a magnification of 100, are not actually so, very pale microtrichia being discernible under a magnification of 300. Secondly, the extreme tips of the femora and bases of the tibiae are blackish, the pale rings being sub-apical and sub-basal respectively, not actually apical and basal. Kieffer does not describe the thoracic markings in detail; possibly his specimen (described from Calcutta), like the two now before me, was a slide mount. The British Museum possesses a third specimen, obviously of the same species, from Bombay (*W. S. Hoseason*), so that it is evidently widely spread in the east, and has probably been described under other names. Patton's *C. kiefferi* (recently renamed *C. pattoni* by Kieffer) is evidently a very similar species, but differs (according to Patton's figure) in the absence of the small white spot beneath the second radial cell, and in having two conspicuous dark costal spots, the area between the second and third pale spots being darker than it is in *C. oxystoma*.

I would call attention also to the very close resemblance between this species and *C. maculithorax*, Williston, known from the West Indies and Brazil. Without having seen males of either, I cannot form an opinion as to how close the relationship is, but a comparison of Jamaican examples of *C. maculithorax* in the British Museum with Indian and Malayan *C. oxystoma* reveals only minute and seemingly unimportant differences; the most obvious of these are that *C. maculithorax* has rather fewer hairs on the wing-membrane, and a rather larger pale spot below the second radial cell, while segments 9-12 of the flagellum are a little more swollen at the base. The two forms agree in having two rather large, nearly globular spermathecae with rather long chitinised necks.

The life-history of a species determined as *C. oxystoma* has recently been described by Patel (Proc. 4th Entom. Meeting, Pusa, p. 272). From the figure of the adult given by the author it would appear that the species is almost certainly wrongly determined; at any rate, Patel's species is quite distinct in wing-markings from Dr. Lamborn's, and does not agree nearly so well with Kieffer's description as does the latter.

**Culicoides peregrinus**, Kieff.

A single female, which appears to be this species, was reared by Dr. Lamborn in company with *C. oxystoma* and *C. guttifer*; the wing is shown in Plate iii, fig. 1.

**Culicoides pungens**, de Meij. (Plate iii, fig. 11).

I am indebted to Dr. de Meijere for the loan of the type (mounted in balsam) of this species, and reproduce herewith a photograph of its wing. It is much smaller than *C. anophelis*, and although the rather faint wing-markings are not dissimilar in the two species, the venation is quite different, the second radial cell in *C. pungens* being so narrow as to be scarcely distinguishable, and very little longer than the first. The British Museum possesses an example of *C. pungens* from Deli, Sumatra, received through the Imperial Bureau of Entomology from Dr. A. T. Stanton in 1915.

**Culicoides arenarius**, sp. n. (Plate iii, fig. 12).

♀.—Colour almost uniformly light ochreous; flagellum and abdomen somewhat darkened; back of head rather dark brown; halteres whitish. Eyes narrowly but distinctly separated, the strip between them narrowed in the middle to less than the width of one facet. Palpi normal, the second (Carter's third) segment moderately enlarged. Antennae normal, practically as figured by Carter, Ingram and Macfie for *C. schulzei* (End.); last segment without terminal style; segments 4-10 about

one and one-third times as long as broad. Thoracic hairs and bristles mostly rather dark brown. Scutellum with two bristles near together in the middle, two more on each side, and rather numerous hairs which are very little smaller than the bristles. Spermathecae two in number, moderately large and nearly globular. Legs normal; first hind tarsal segment scarcely twice as long as the second, and scarcely half as long as the tibia; fourth tarsal segments cylindrical, as long as the fifth. Wings hyaline and entirely unmarked, surface rather densely and uniformly covered with greyish hairs. Radial cells both narrow, the lumen about as broad as one of the veins; second cell a little longer than the first. Cross-vein rather more oblique than usual.

BRITISH SOMALILAND: Burao, xi.1914-i.1915 (*Dr. R. E. Drake-Brockman*), "collected inside tent, biting at midday"; six ♀♀ (cotypes), presented to the British Museum by the London School of Tropical Medicine.

I know of no other described *Culicoides* with uniform ochreous thorax and entirely unspotted wings, but the species is an absolutely typical member of the genus, with no structural peculiarities.

***Culicoides loughnani*, sp. n.** (Plate iii, fig. 9).

Black; mesonotum yellowish-brown, faintly lined (according to collector; the specimens were preserved in spirit and the true coloration lost). Wings with dark ground-colour, with pale spots and streaks.

Antennae with segments 2-9 nearly globular, 8 and 9 about one-third longer than broad; verticils about twice as long as each segment; sensory hairs three in number on each segment, about two-thirds as long as the verticils and nearly twice as thick. Segments 10-14 together about one-sixth longer than 2-9, 10-13 of equal length, 14 one-third longer, without stylet, all with long pubescence in addition to the basal verticils, but without sensory hairs. Palpi with the second joint considerably swollen, expanded on the inner side on the apical half, last two joints nearly cylindrical, each about twice as long as broad; together only half as long as the second joint. Mesonotum with short dark pubescence. Legs dark brown; a narrow whitish ring near the tip of each femur, and another near the base of each tibia; tarsi pale. First segment of hind tarsi rather more than twice as long as the second. Wings with dark ground-colour and paler markings (see figure); three black marks towards costa, the middle one darkest and broadest, covering the whole of the second and part of the first radial cell; pale streaks bordering the median and cubital veins. Whole surface with numerous macrotrichia, except for the costal and basal cells. Radial cells very narrow, the first half as long again as the second. Stem of median cell longer than the cross-vein. Halteres whitish. Length 1.3 mm.

JAMAICA: Kingston (*Major W. F. M. Loughnan, R.A.M.C.*), two ♀♀.

The collector notes that the species is common in Jamaica, and bites all through the afternoon, being most active as sunset approaches. In wing-markings it much resembles Williston's *C. maculithorax*, described from St. Vincent, which differs in having the wings hairy only at the tips, and a spotted mesonotum. *C. maculithorax* also occurs on the island, and its wing is figured (Plate iii, fig. 8) for comparison with that of *C. loughnani*. The difference between the two is almost exactly parallel to that between the Oriental *C. pattoni* and *C. oxystoma*.

***Culicoides loughnani* var. *jamaicensis*, n.** (Plate iii, fig. 10).

Differs from *C. loughnani* as follows:—Wings darker, with a much larger dark area on the basal half of the costa; the spot over the radial cells, however, is not so conspicuously black; veins not pale-margined, except at the tips.

JAMAICA: Kingston (*Major W. F. M. Loughnan, R.A.M.C.*), two ♀♀, sent with *C. loughnani*.

The wing-markings are very similar to those of *C. phlebotomus*, Will., from St. Vincent, which has only the tips of the wings hairy.

Genus **Lasiohelea**, Kieff.

*Lasiohelea*, Kieffer, Arch. Inst. Pasteur Afr. Nord, Algiers, i, no. 1, p. 115 (1921).  
*Centrorhynchus*, Lutz, Mem. Inst. Oswaldo Cruz, v, p. 62 (1913); preoccupied  
 by *Centrorhynchus*, Lühe, 1911 (Vermes).

The genus *Centrorhynchus* was proposed by Lutz for two Brazilian species, *C. stylifer* and *C. setifer*, the former being regarded as the genotype. Lutz's diagnosis is not very detailed, and it would seem that he meant the genus to include any biting CERATOPOGONINAE with completely unspotted wings. In a subsequent publication, Lutz identifies the previously described *Cotocripus caridei*, Bréthes, with his *Centrorhynchus setifer*, and proposes to adopt Bréthes' name *Cotocripus* for his genus.

The British Museum is indebted to Prof. R. Newstead and Mr. H. F. Carter for specimens of both *Centrorhynchus stylifer* and *C. setifer*, named by Dr. Lutz; the specimen of the former was taken from horses' ears at Villa Nova, Bahia, Brazil. In the writer's opinion, the two species are not congeneric, *C. setifer* (and therefore presumably *Cotocripus caridei*) being only a slightly modified *Culicoides*, without any empodium, while *C. stylifer* is quite different, belonging to the *Forcipomyia* group, with a well-developed empodium, and closely resembling in its venation and most other characters the European *Ceratopogon velox*, Winn. This resemblance between *C. stylifer* and *C. velox* clearly indicates that these two are congeneric, but since Lutz's name is preoccupied, and *Cotocripus* is shown not to be applicable, another name must be searched for.

Kieffer has recently (Ann. Mus. Nat. Hung., xvii, p. 23, 1919) described a so-called new species as *Atrichopogon pilosipennis*, and still more recently, in the paper quoted above, has introduced for this species the generic name *Lasiohelea*. Now *A. pilosipennis* is so similar to Winnertz's *C. velox* that it seems quite probable that the two are identical. Kieffer's name *Lasiohelea* may therefore be used to replace Lutz's *Centrorhynchus*.

The structural characters of *Lasiohelea*, as pointed out by Kieffer, are intermediate between *Atrichopogon* and *Forcipomyia*. It resembles the former genus in the structure of the antennae and in the venation, notably in the very long second radial cell, which extends well beyond the middle of the wing; this cell, however, is narrower than it is in *Atrichopogon*, the radius being almost in contact with the costa, while the first radial cell is obliterated by the fusion of  $R_1$  and  $R_s$ .

On the other hand, the relationship to *Forcipomyia* is shown by the rather densely hairy wings, though the hairs are less close-lying than in *Forcipomyia*, and there are bare lines adjoining the veins, as in *Atrichopogon*. Among the larger hairs, which are spread over nearly the whole surface, can be distinguished small microtrichia, smaller than those of *Atrichopogon*, but more obvious than those of *Forcipomyia*.

Besides *L. stylifer* (Lutz), of South America, and *L. velox* (Winn.) (*pilosipennis*, Kieffer), of Europe, two other described species may be referred to this genus. These are *Forcipomyia lefanui*, Carter, described from the Gold Coast, and *Ceratopogon stimulans*, de Meijere, described from Sumatra. These species are practically identical in structure with *L. stylifer*, and, like Lutz's species, are known to have blood-sucking habits. Of *L. lefanui*, the British Museum possesses a paratype obtained (biting) by Dr. Le Fanu on the Gold Coast, and also a long series collected by Dr. W. A. Lamborn at Ibadan, S. Nigeria. Of *L. stimulans*, the Museum has a specimen from Deli, Sumatra, received from Dr. A. T. Stanton; several from Peradeniya, Ceylon, collected (biting) by Messrs. E. E. Green and A. Rutherford; and a series of females, without doubt specifically identical with those from Ceylon, from various localities in Queensland, some collected biting or labelled "troublesome sand-fly," from Dr. T. L. Bancroft.

The genus *Lasiohelea*, then, is the third member of the CERATOPOGONINAE, whose species are mostly or all habitual blood-suckers, the one possible exception being

*L. velox*, a rare species whose habits have not been observed. It would seem that in this subfamily only the three genera, *Leptoconops* (sens. lat.), *Culicoides* and *Lasiohelea*, are regularly addicted to sucking the blood of mammals. Recorded cases of blood-sucking by members of any of the other genera are very few, and some even of these can be eliminated. Thus Meigen's statement, repeated by Verrall, that *Forcipomyia bipunctata* bites severely, is certainly due either to an error of identification, or to a more or less accidental occurrence; the species is abundant in this country and has never been observed to bite within recent years. Austen's *Johannseniella fulvithorax*, taken in the act of biting, is really a *Culicoides*, as recently shown by Carter. De Meijere's *Ceratopogon salmi* and *C. vexans*, described as blood-sucking species, appear from the descriptions to belong either to *Forcipomyia* or *Dasyhelea*. Prof. de Meijere informs me that there is no actual evidence that they suck blood, the collector merely supposing them to be capable of doing so on account of the structure of their mouth-parts; the specimens described by de Meijere were mostly captured at light. Malloch's record of the biting of *Dasyhelea grisea* stands alone so far as this genus is concerned, and confirmation is desirable; I have seen no evidence that any of the British species of *Dasyhelea*, one of which is closely allied to *D. grisea*, ever attempt to suck blood. Kieffer has recently published a paper entitled "Nouveaux Chironomides piqueurs habitant le Sleswig-Holstein" (Ann. Soc. Sci. Bruxelles, Feb. 1922) in which various species of *Forcipomyia* and *Atrichopogon*, as well as *Culicoides* are described, but he adduces no evidence to show that any of the species are actually blood-suckers.

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